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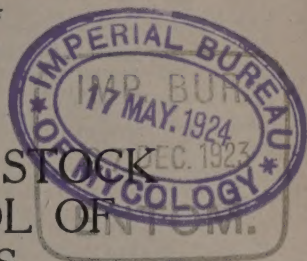
AGRICULTURAL EXPERIMENT STATION OF THE
NEW YORK STATE COLLEGE OF AGRICULTURE

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DUSTING NURSERY STOCK FOR THE CONTROL OF LEAF DISEASES

BY V. B. STEWART



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DUSTING NURSERY STOCK FOR THE CONTROL OF LEAF DISEASES¹

V. B. STEWART

In spraying for the control of leaf diseases of nursery stock, one of the most important problems confronting the nurseryman is a satisfactory means of applying the spray mixture. An outfit is desirable which will apply the spray with sufficient force and with the least inconvenience, permitting the work to be done with considerable rapidity and as economically as possible. Several different types of spraying machines have been constructed, but none have been satisfactory. It is difficult to build a machine that can be transported over tall nursery trees. On the other hand, the narrow space separating the nursery rows makes it difficult to construct a sprayer that will run between the rows. Also, with the sprayers that have been used, only a relatively small amount of stock can be covered within a given length of time; this not only increases the expense, but in many cases it is impossible to cover all of the susceptible stock before it is too late for the application to be effective.

Some of these difficulties are found in connection with orchard spraying also. In order to find a means of obviating them, several experiments have been conducted by the Cornell University Agricultural Experiment Station within recent years, in dusting the trees instead of spraying them (Fig. 1). Most of the work has been done by Blodgett² and by Reddick and Crosby.³ As a whole these dusting experiments, conducted in the orchards of New York State, have proved satisfactory, and many orchardists are adopting this method in preference to spraying.

It is claimed for the dust method that the time of application is not limited by soil conditions, inasmuch as the lightness of the outfit permits its transportation at all times; also, that blocks of trees on rough or hilly ground, or in localities remote from an adequate water supply, may be protected without unusual difficulty.

The cost of spraying solutions is less than that of the dust mixture. The actual expense for the dust method, however, is but slightly greater than that for the liquid, since the handling of a large bulk of water is eliminated, the outfit is less expensive, and the operators are fewer in number. On the other hand, even though the dust method should prove considerably more expensive, the great saving in time, and especially the ability to cover large areas at critical periods in a minimum of time, would largely offset the increased cost of the dust mixture.

In view of the success of dusting in apple orchards the method appeared worthy of trial in the nursery, where conditions are entirely different, there being many diseases affecting the various kinds of nursery plants. During the past season, therefore, experiments were performed in nursery plantings

¹ A more complete report of the experiments mentioned in this circular is reserved for a future publication.

² Blodgett, F. M. Experiments in the dusting and spraying of apples. Cornell Univ. Agr. Exp. Sta. Bul. 340: 147-179. 1914.

³ Reddick, Donald, and Crosby, C. R. Further experiments in the dusting and spraying of apples. Cornell Univ. Agr. Exp. Sta. Bul. 354: 51-96. 1915.

Reddick, Donald, and Crosby, C. R. Dusting and spraying experiments with apples. Cornell Univ. Agr. Exp. Sta. Bul. 369: 309-356. 1916.

to determine the relative value of dusting and spraying for the control of leaf diseases of cherry, rose, currant, and horse-chestnut. Owing to the possibility that the dust method might fail to prove effective, only a few hundred plants were included in each experiment. All the spraying and dusting was done by hand.

The dust mixture used in all experiments was ninety parts of finely ground sulfur⁴ and ten parts of powdered lead arsenate. The lead arsenate was added, not only for its value as an insecticide against chewing insects, but also, and primarily, for its adhesive properties. When lead arsenate



FIG. 1. DUSTING ORCHARD TREES

With this machine the dust can be driven through trees with very dense foliage

is moistened there is a tendency for it to become somewhat gelatinous and sticky, thus increasing the adhesiveness and spreading quality of the mixture. The dusting machine used is shown in figure 2.

The sprayed plats were treated with commercial lime-sulfur solution, diluted one gallon to fifty gallons of water. The solution was applied with a compressed-air hand sprayer.

The experiments were performed in two different nurseries, and, although they were conducted on a small scale, the results give an indication as to the effectiveness of the dust mixture.

⁴ The sulfur was so finely ground that at least 95 per cent would pass through a 200-mesh sieve. The method of testing sulfur is described by F. M. Blodgett in Bulletin 328 of the Cornell University Agricultural Experiment Station.

EXPERIMENT FOR THE CONTROL OF LEAF SPOT OF THE CHERRY⁵

The leaf spot, or yellow leaf, of cherries usually may be controlled by from five to seven treatments of lime-sulfur solution, diluted one to fifty, applied at intervals of from two to three weeks.

In the experiment for the control of this disease, four rows of Tartarian cherries in a large block of first-year sweet cherry trees were selected, and a part of each row was included in the respective plats. The rows



FIG 2. A HAND DUSTING MACHINE

This machine is suitable for treating small plantings of nursery stock

extended east and west. Starting at the east side the plats were treated as follows: the trees in the first 100 feet of the four rows were dusted with the mixture of finely ground sulfur and powdered arsenate of lead; those in the next 125 feet were left untreated; and those in the last 100 feet were sprayed with lime-sulfur solution diluted one to fifty.

The first application of dust and spray was made on May 11, when the trees were about six inches high. In order to protect as much of the new foliage as possible at all times, the second application was made on May 25, when the trees were about eight to ten inches high. Other applications were made on June 7, June 27, July 9, July 19, and August 2.

⁵ The cherry leaf spot disease is caused by the fungus *Coccomyces hiemalis* Higgins.

Because of the heavy rainfall and the numerous infection periods during the summer, the applications did not thoroughly protect all of the new growth and many infections occurred in all the plats. On the other hand, the trees in the treated plats were not so severely infected as were the untreated trees. Final observations and results on the experiment were recorded on August 31. The percentage of premature defoliation caused by the disease was determined by counting the number of leaf scars on each tree where leaves were missing. In the untreated plat the average loss of leaves for each tree was thirty-seven per cent; in the dusted plat the average loss of leaves per tree was eight per cent, as compared with fifteen per cent for the sprayed trees.

Several factors are involved in accounting for the failure of the lime-sulfur solution to be as effective as the dust mixture, the most important of which may be the location of the different plats. The dusted trees were at the east end of the rows, where there was a gentle slope conducive to proper drainage; while the sprayed plat was on lower land, which did not drain so readily, and where often after periods of heavy rainfall the soil remained saturated with water for a considerable time. Not only did the excess of water affect the growth of the trees in that area, but also the moist conditions favored the leaf-spot disease and more infections occurred.

Most of the foliage in the sprayed and in the dusted plat showed only a few infections and was still green, while a large proportion of the affected leaves in the check plat were turning yellow and were of little value to the trees.

CONTROL OF MILDEW ON CHERRIES⁶

Although the mildew is ordinarily more destructive on sour cherries than on the sweet varieties, the disease was very common on all varieties of cherries during the season of 1915. The applications made for the control of cherry leaf spot were effective in controlling the mildew also. On August 31 practically all the foliage on the trees in the check plat in the preceding experiments showed the presence of the disease, and many of the leaves were curled and dried out. Very little mildew was present on the trees in the treated plats, and none of the foliage was severely affected. These observations indicate that the dust mixture, as well as the lime-sulfur solution, is effective in controlling the mildew disease of cherries.

EXPERIMENT FOR THE CONTROL OF LEAF BLOTCH OF HORSE-CHESTNUT⁷

A single row of large four-years-old horse-chestnut trees was selected for the experiment on leaf blotch. The trees were about six feet high and comprised the last row of a large block of ornamental stock. The row extended north and south. Starting at the north end, the trees in the first 150 feet of the row were treated with the dust mixture; those in the next 50 feet were left untreated for a check; those in the next 100 feet were sprayed with lime-sulfur solution, one to fifty; those in the last 75 feet were left untreated for a check.

⁶ The mildew of cherries is caused by the fungous pathogene *Podosphaera oxyacanthæ* (DC.) de Bary.

⁷ The leaf blotch disease of horse-chestnut is caused by the fungous pathogene *Guignardia Eschli* (Pk.) Stewart.

The first application of dust and spray was made on May 11, when all the buds had opened and some of the leaves were well developed. The second application was made on May 25, when practically all of the older leaves were fully developed. The third application was made on June 7. Because of the wet season and the numerous infection periods, three other applications were made, on June 21, July 9, and August 2, respectively.

When the final observations were made, on August 30, the trees in the check plats were badly affected and had the appearance of having been burned over by fire. A comparison of the trees in the different plats was obtained by determining the average number and percentage of affected leaves on each tree. No attempt was made to record the



PHOTOGRAPH BY F. E. GLADWIN

FIG. 3. A TRACTION DUSTING MACHINE

The dust mixture is discharged from the two pipes in the rear of the machine

number of infections on each leaf. In the untreated plats especially the leaves were severely affected, while most of the diseased leaves on the treated trees showed only one or two small lesions. In the dusted plat there were seventy-two trees and only about three per cent of the foliage was affected; approximately ten per cent of the foliage on the sixty-one sprayed trees was diseased; and on the fifty-five untreated trees fifty-nine per cent of the foliage was affected.

In comparing the sprayed and the dusted trees it is believed that the lime-sulfur spray was less effective mainly because of the dense foliage on the trees. With a hand sprayer the power was not sufficient to furnish a driving spray that would thoroughly cover all parts of this dense foliage. On the other hand, the cloud of finely ground dust mixture floated through the trees and settled on the leaves, completely covering them, and thereby affording better protection than the liquid spray.

EXPERIMENT FOR THE CONTROL OF THE LEAF SPOTS OF CURRANTS⁸

The leaf spots of currants, which in many cases cause heavy defoliation, may usually be controlled by five or six applications of lime-sulfur solution, diluted at the rate of one gallon to fifty gallons of water. The experiment for the control of these diseases included several rows, about seventy feet in length, of second-year Cherry currant bushes. These rows were on the north side of a large block of currants. The first six rows were treated with the dust mixture; row 7 served as a buffer row and was not treated; rows 8, 9, 10, and 11 were sprayed with lime-sulfur solution diluted one to fifty; rows 12, 13, 14, 15, 16, and 17 were left untreated for a check.



PHOTOGRAPH BY F. M. BLODGETT

FIG. 4. A TRACTION DUSTER

This machine is suitable for dusting nursery stock

On May 10 the first application was made, there being at that time several clusters of leaves on the bushes. The next application was made on May 25, when many leaves were fully developed and the numerous new shoots were growing rapidly. Other applications were made on June 7, June 21, July 9, July 19, and August 2. The frequent heavy rains necessitated the numerous treatments.

Final data on the experiment were recorded on September 3, when a large part of the foliage on the untreated bushes had already fallen. At least sixty per cent of the leaves were missing and many of the bushes were completely defoliated. The bushes on the treated plots were still growing and the premature defoliation caused by the leaf spots was but slight. There was practically no difference in appearance between the sprayed and the dusted bushes; both fungicides proved effective in preventing premature defoliation caused by the leaf spot diseases. The

⁸ The leaf spot caused by *Septoria ribis* Desm. and the anthracnose caused by *Pseudopeziza ribis* Kleb. are commonly found on currant nursery stock in New York State.

dust mixture apparently penetrated better than the spray, for in the dusted plat a much larger proportion of leaves were retained on the trunks of the plants than in the sprayed plat.

EXPERIMENT FOR THE CONTROL OF ROSE MILDEW⁹

Lime-sulfur solution, diluted one to fifty, is effective for the control of rose mildew, but owing to the time and labor involved in applying the spray solution the use of a dust mixture is preferable. During the past season an experiment was conducted for the control of mildew on large Crimson Rambler rosebushes. The bushes were planted thickly and formed an arbor several hundred feet in length. The bushes along about eighty feet of the arbor were dusted; the remainder of the bushes were not treated and served as a check on the experiment.



PHOTOGRAPH BY F. M. BLODGETT

FIG. 5. THE TRACTION DUSTER IN OPERATION

The discharge pipes on this machine can be lowered and raised according to the height of the nursery stock

The first application of dust was made on June 18, just as the mildew began to appear on the blossom buds and at the tips of the young shoots. The second application was made on July 12, and on that date considerably more mildew was present. Two other applications were made, on July 21 and August 5, respectively. At the time of the last treatment the dusted bushes were still practically free from mildew, only a few infected leaves being apparent, and the young shoots were growing rapidly. The untreated bushes immediately next to the dusted plat were severely infected; many of the leaves and shoots were dried out and killed by the mildew, and very little of the foliage was free from the disease. By preventing injury to the foliage and the young shoots, the dust mixture enabled the treated bushes to retain their beauty and to appear green and healthy throughout the summer.

⁹ The mildew on roses is caused by the fungous pathogene *Sphaerotheca pannosa* (Wallr.) Lév. var. *rosa* Wor.

SUMMARY

In the various experiments herein discussed, the finely ground sulfur in the dust mixture proved as efficient a fungicide as lime-sulfur solution. The results obtained warrant further trials on a more extensive scale.

If dusting on a commercial scale proves effective in the nursery, the problem of controlling leaf diseases of nursery stock should be materially lessened. There are numerous types of traction dusting machines which, with a few changes, would be suitable for use in the nursery (Figs. 3, 4, and 5). With the dust method only one man and a horse are necessary to operate the machines, which run between the rows; and the work can be done in a much shorter time than with the usual spraying machines now employed by nurserymen.

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